Monthly Progress Report 3

DEVELOPMENT OF A LOW-NOISE, COLD-CATHODE TRAVELING-WAVE TUBE

This report covers 31 October 1964 to 30 November 1964

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prepared for

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Goddard Space Flight Center
Greenbelt, Maryland

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I. OBJECTIVE

The objective of this program is the development of a Schottky cold cathode suitable for installation as an electron beam source in an ultralow-noise traveling-wave tube, and the development of a 6 Gc traveling-wave tube adapted for using this cold cathode. The cathode development task is being performed by Stanford Research Institute and the responsibility of the entire program and of the traveling-wave tube development rests with Microwave Electronics Corporation.

Particular tasks include the identification and development of material technology, fabrication techniques, and emission tests (SRI), and the life testing, development of processing and bake-out techniques, and integration of the cold-cathode emitter into a TWT vacuum envelope with known low-noise characteristics when operated with a thermionic cathode.

The ultimate objective is the delivery to NASA of a cold-cathode 6-Gc traveling-wave tube with a 1-milliwatt saturated power output level derived from a beam current of 200 microamperes, and an objective noise figure of 3 db.

II. PROGRESS DURING THIS REPORT PERIOD

Task 1: Development of Cold Cathode

Progress on this task is described in the attached SRI Monthly Progress Report.

Task 2: Development of Cold Cathode Processing Techniques

During this report period, two metal-ceramic diodes have been fabricated. They will be used to test the SRI cold cathodes as they become available. This diode is shown in Fig. 1.

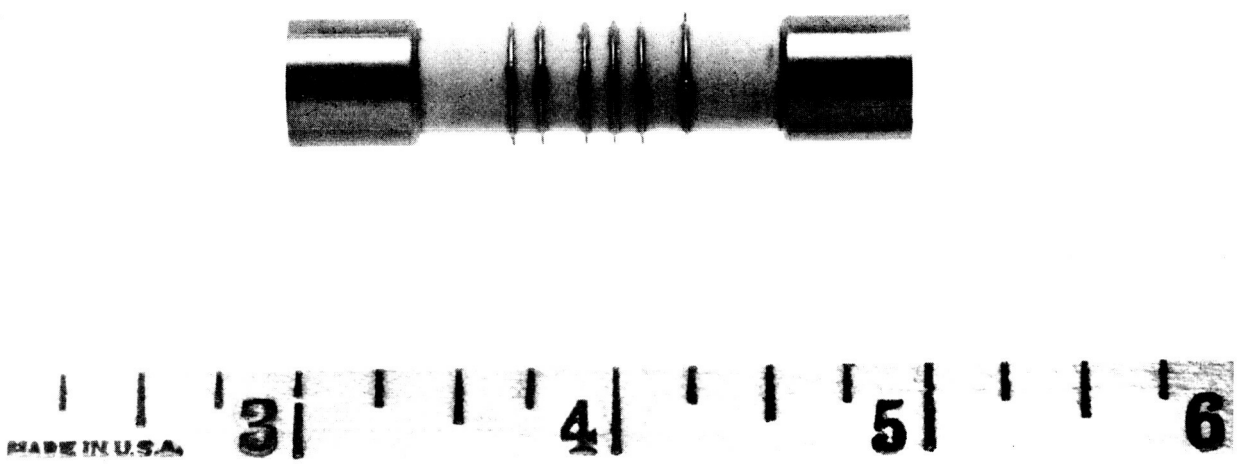

Fig. 1. Fabricated gun for cold cathode operation.

The gun is made with two cathode support structures. Between them are electrodes which will be used to collect emitted electrons from the cold cathode. One support is for the cold cathode; the other for the barium oxide source. (This BaO source will be barium carbonate sprayed on a standard nickel base cathode. The carbonate will then be broken down by heating.)

The electrodes, supports and pump-out parts are made of 404 monel. The ceramic spacers are AD-94 Coors alumina. The brazing materials used are thin titanium discs. These parts are chemically and thermally cleaned before they are assembled. Brazing occurs at 850°C in a vacuum. To ensure a clean assembly, the diodes will be outgassed at 750°C shortly before use.

After the two cathodes are inserted, heaters will be placed in both structures and a sealing plug will be brazed on the cold cathode end. Then a tubulation assembly with an appendage pump in line will be brazed on the other end of the diode. This structure will then be placed on a larger pump and baked out at 625°C to ensure cleanliness.

The BaO cathode will be broken down by applying the proper heater voltage. This vacuum assembly consisting of the cold cathode, the BaO source and the small appendage pump will then be removed from the large pump and be ready for activation and emission tests.